

CLAIMS

[1] A substrate cleaning method which performs a cleaning process and a dry process on a target substrate, the dry process comprising the steps of:

5 rotating the target substrate in an approximately horizontal state, and starting feeding a rinse liquid to a center of a surface of the target substrate;

10 starting feeding an inactive gas to a point at an adequate distance apart from the center of the target substrate in a vicinity of the center of the target substrate; and

15 moving a gas feed point for supply of the inactive gas to the target substrate toward the center of the target substrate while moving a rinse-liquid feed point for supply of the rinse liquid to the target substrate, and then moving the gas feed point toward a periphery from the center of the target substrate in an area located radially inward of the rinse-liquid feed point.

20 [2] The substrate cleaning method according to claim 1, wherein feeding the inactive gas to the point at the adequate distance apart from the center of the target substrate in the vicinity of the center of the target substrate is started substantially at a same time as initiation of feeding the rinse liquid to the center of the surface of the target substrate.

25 [3] The substrate cleaning method according to claim 1, wherein a moving speed of the gas feed point is

made faster at a circumferential portion of the target substrate than at a center portion thereof.

[4] The substrate cleaning method according to claim 1, wherein a rinse process which feeds the rinse liquid to a predetermined point of the surface of the target substrate for a predetermined time while rotating the target substrate in an approximately horizontal state is provided between the cleaning process and the dry process, and a number of rotations of the target substrate at a time of feeding the inactive gas is set greater than a number of rotations of the target substrate at a time of the rinse process.

[5] The substrate cleaning method according to claim 1, wherein a rinse process which feeds the rinse liquid to a predetermined point of the surface of the target substrate for a predetermined time while rotating the target substrate in an approximately horizontal state is provided between the cleaning process and the dry process, and an amount of the rinse liquid to be fed to the surface of the target substrate at a time of the dry process is made less than that at a time of the rinse process.

[6] The substrate cleaning method according to claim 1, wherein a rinse process which feeds the rinse liquid to a predetermined point of the surface of the target substrate for a predetermined time while rotating the target substrate in an approximately horizontal state is

provided between the cleaning process and the dry process, and a film of the rinse liquid is formed on the surface of the target substrate before initiation of the dry process.

5 [7] The substrate cleaning method according to claim 1, wherein after the rinse-liquid feed point comes off the periphery of the target substrate, the gas feed point is stopped near a circumferential portion of the target substrate for a predetermined time, thereby drying the 10 circumferential portion of the target substrate.

15 [8] The substrate cleaning method according to claim 1, wherein in the step of moving the rinse-liquid feed point and the gas feed point in the dry process, a direction in which the gas feed point moves from the center of the target substrate to the periphery thereof is shifted from a direction in which the rinse-liquid feed point moves from the center of the target substrate to the periphery thereof.

20 [9] The substrate cleaning method according to claim 1, wherein the surface of the target substrate is hydrophobic.

[10] A substrate cleaning method which performs a cleaning process and a dry process on a target substrate, the dry process including the steps of:

25 rotating the target substrate in an approximately horizontal state, and feeding a rinse liquid while moving a feed point thereof from a center of a surface of the

target substrate toward a periphery thereof;

feeding an inactive gas in such a way that a gas feed point thereof moves from a center portion of the target substrate toward the periphery thereof in an area located radially inward of the rinse-liquid feed point;

stopping feeding the rinse liquid after the rinse-liquid feed point comes off an end face of the target substrate; and

stopping feeding the inactive gas after the inactive-gas feed point comes off the end face of the target substrate, and then setting a number of rotations of the target substrate greater than a number of rotations of the target substrate at a time of feeding the inactive gas.

[11] The substrate cleaning method according to claim 10, wherein a moving speed of the gas feed point is made faster at a circumferential portion of the target substrate than at a center portion thereof.

[12] The substrate cleaning method according to claim 10, wherein a rinse process which feeds the rinse liquid to a predetermined point of the surface of the target substrate for a predetermined time while rotating the target substrate in an approximately horizontal state is provided between the cleaning process and the dry process, and a number of rotations of the target substrate at a time of feeding the inactive gas is set greater than a number of rotations of the target

substrate at a time of the rinse process.

[13] The substrate cleaning method according to
claim 10, wherein a rinse process which feeds the rinse
liquid to a predetermined point of the surface of the
5 target substrate for a predetermined time while rotating
the target substrate in an approximately horizontal state
is provided between the cleaning process and the dry
process, and an amount of the rinse liquid to be fed to
the surface of the target substrate at a time of the dry
10 process is made less than that at a time of the rinse
process.

[14] The substrate cleaning method according to
claim 10, wherein a rinse process which feeds the rinse
liquid to a predetermined point of the surface of the
15 target substrate for a predetermined time while rotating
the target substrate in an approximately horizontal state
is provided between the cleaning process and the dry
process, and a film of the rinse liquid is formed on the
surface of the target substrate before initiation of the
20 dry process.

[15] The substrate cleaning method according to
claim 10, wherein after the rinse-liquid feed point comes
off the periphery of the target substrate, the gas feed
point is stopped near a circumferential portion of the
25 target substrate for a predetermined time, thereby drying
the circumferential portion of the target substrate.

[16] The substrate cleaning method according to

claim 10, wherein in the step of moving the rinse-liquid feed point and the gas feed point in the dry process, a direction in which the gas feed point moves from the center of the target substrate to the periphery thereof
5 is shifted from a direction in which the rinse-liquid feed point moves from the center of the target substrate to the periphery thereof.

[17] The substrate cleaning method according to
claim 10, wherein the surface of the target substrate is
10 hydrophobic.

[18] A substrate cleaning apparatus which performs a cleaning process and a dry process on a target substrate, and comprises:

15 a spin chuck which holds the target substrate and rotates the target substrate in an approximately horizontal state;

a cleaning mechanism which performs a predetermined cleaning process on the target substrate held by the spin chuck;

20 a rinse nozzle which feeds a rinse liquid to the target substrate held by the spin chuck;

a gas nozzle which feeds an inactive gas to the target substrate held by the spin chuck; and

25 a nozzle control apparatus which causes the rinse nozzle to scan the target substrate from a center thereof to a periphery thereof while spraying the rinse liquid from the rinse nozzle, causes the gas nozzle to scan the

target substrate from near a center portion thereof to
the center thereof while injecting the inactive gas from
the gas nozzle, and then causes the gas nozzle to scan
the target substrate toward the periphery thereof in an
5 area located radially inward of a position of the rinse
nozzle.

[19] The substrate cleaning apparatus according to
claim 18, wherein the nozzle control apparatus causes the
gas nozzle to scan faster at a circumferential portion of
10 the target substrate than at the center portion thereof.

[20] The substrate cleaning apparatus according to
claim 18, wherein the nozzle control apparatus causes the
rinse nozzle and the gas nozzle to perform scanning with
a direction of causing the rinse nozzle to perform
15 scanning from the center of the target substrate to the
periphery thereof being shifted from a direction causing
the gas nozzle to perform scanning from the center of the
target substrate to the periphery thereof.

[21] A computer program including software which
20 runs on a computer and controls a substrate cleaning
apparatus in such a way as to clean a target substrate by
executing a process of drying the target substrate by,
when execute, (a) rotating the target substrate undergone
a cleaning process, and starting feeding a rinse liquid
25 to a center of a surface of the target substrate, (b)
starting feeding an inactive gas to a point at an
adequate distance apart from the center of the target

substrate in a vicinity of the center of the target substrate, and (c) moving a gas feed point for supply of the inactive gas to the target substrate toward the center of the target substrate while moving a rinse-
5 liquid feed point for supply of the rinse liquid to the target substrate, and then moving the gas feed point toward a periphery from the center of the target substrate in an area located radially inward of the rinse-liquid feed point.

10 [22] A computer program including software which runs on a computer and controls a substrate cleaning apparatus in such a way as to clean a target substrate by executing a process of drying the target substrate by, when execute, (a) rotating the target substrate undergone a cleaning process in an approximately horizontal state, and feeding a rinse liquid while moving a feed point thereof from a center of a surface of the target substrate toward a periphery thereof, (b) feeding an inactive gas in such a way that a gas feed point thereof moves from a center portion of the target substrate toward the periphery thereof in an area located radially inward of the rinse-liquid feed point, (c) stopping feeding the rinse liquid after the rinse-liquid feed point comes off an end face of the target substrate, and
15 (d) stopping feeding the inactive gas after the inactive-gas feed point comes off the end face of the target substrate, and then setting a number of rotations of the
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target substrate greater than a number of rotations of the target substrate at a time of feeding the inactive gas.

[23] A computer readable storage medium having
5 recorded software for allowing a computer to run a control program which controls a substrate cleaning apparatus in such a way as to clean a target substrate by executing a process of drying the target substrate by, when execute, (a) rotating the target substrate undergone
10 a cleaning process, and starting feeding a rinse liquid to a center of a surface of the target substrate, (b) starting feeding an inactive gas to a point at an adequate distance apart from the center of the target substrate in a vicinity of the center of the target
15 substrate, and (c) moving a gas feed point for supply of the inactive gas to the target substrate toward the center of the target substrate while moving a rinse-liquid feed point for supply of the rinse liquid to the target substrate, and then moving the gas feed point
20 toward a periphery from the center of the target substrate in an area located radially inward of the rinse-liquid feed point.

[24] A computer readable storage medium having
recorded software for allowing a computer to run a
25 control program which controls a substrate cleaning apparatus in such a way as to clean a target substrate by executing a process of drying the target substrate by,

when execute, (a) rotating the target substrate undergone a cleaning process in an approximately horizontal state, and feeding a rinse liquid while moving a feed point thereof from a center of a surface of the target

5 substrate toward a periphery thereof, (b) feeding an inactive gas in such a way that a gas feed point thereof moves from a center portion of the target substrate toward the periphery thereof in an area located radially inward of the rinse-liquid feed point, (c) stopping

10 feeding the rinse liquid after the rinse-liquid feed point comes off an end face of the target substrate, and (d) stopping feeding the inactive gas after the inactive-gas feed point comes off the end face of the target substrate, and then setting a number of rotations of the

15 target substrate greater than a number of rotations of the target substrate at a time of feeding the inactive gas.